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Delivering Eye Care to Homeless and Marginally Housed Populations during the Coronavirus-19 Pandemic: A Pilot Study

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Running head: Providing Ocular Care to the Homeless during COVID-19

Delivering Eye Care to Homeless and Marginally Housed Populations during the Coronavirus-19 Pandemic: A Pilot Study

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Precis:

In our sample, homeless and marginally housed populations experienced a higher prevalence of visual impairment relative to the general population. A mobile, tent-based screening program may present a practical method for providing care to this population during a pandemic.

Abstract:

Background: Homeless and marginally housed populations experience a higher prevalence of visual impairment relative to the general population. The aim of this pilot study is to present a novel model for conducting ocular screening clinics for homeless individuals during a pandemic, and to describe the status of ocular health in this population during this time.

Study Design: Cross-sectional study.

Methods: Three outdoor, tent-based ocular screening clinics were held in a park in Toronto, Canada. Most participants were recruited from local shelters, however additional spots were allocated for homeless individuals on a drop-in basis. Prior to enrollment, each participant underwent COVID-19 screening via a questionnaire and temperature measurement. Those who screened negative received a comprehensive eye exam including vision testing, dilated fundus examination, and auto-refraction.

Results: Eleven individuals completed all assessments. The mean age of participants was 54.5 years, and 11 of the participants were men. Visual impairment was found in 5 individuals.

Refractive error via pinhole testing was found in 1 patient. Ocular pathology in this sample was found in 4 participants. Two patients required a referral to an ophthalmologist. From a psychosocial perspective, 4 participants reported significant difficulties.

Conclusions: This novel, tent-based ocular screening program provides a viable option for screening in a pandemic.

Introduction:

The homeless and marginally housed (HMH) population represents a vulnerable group in society that is subject to an increased burden of illness relative to the general population. In addition to a multitude of general comorbidities, lower income has been shown to be associated with poor ocular health, including an increased incidence of glaucoma, cataracts, and dissatisfaction with vision.¹⁻⁴

At baseline, this group faces a number of structural barriers to accessing ophthalmic care. The introduction of COVID-19 clinical guidelines has resulted in a significant reduction in in-person clinical activity, and widespread lockdowns have forced some clinics to cease operations entirely.⁵ Furthermore, patients are reluctant to seek care due to fear of COVID-19 exposure. Consequently, patients are now presenting with more serious sequelae of ocular disease.^{6,7}

Since the onset of the pandemic, there has been a rise in tent encampments in Canadian urban centres due to fear of contracting COVID-19 in shelters, which may impact access to ocular care due to a lack of support typically provided by shelters.^{8,9} The aim of this pilot study, is to describe a novel tent-based ocular screening clinic model which constitutes a cost-effective method for screening and conforms to the current best practice guidelines outlined by Public Health Ontario. We also provide insight into the ocular health of this population during the pandemic.

Methods:

Three outdoor mobile ocular screening clinics were held in a downtown park in Toronto, Ontario between September to October 2020. The location was selected based on the proximity to the Sherbourne Health Bus, a mobile medical facility serving downtown Toronto's HMH population. Clinics were held between 16:00 to 20:00 hours. Ethics approval was obtained from the St. Michael's Hospital Ethics Review Board (#20-214). The study was conducted in accordance with the Declaration of Helsinki and all participants provided written informed consent to participate. Funding for the mobile clinic tent structure, medical equipment, personal protective equipment, and prescription spectacles was obtained from the St. Michael's Hospital Foundation.

Our group has previously described the nature and implementation of ocular screening programs for vulnerable populations.¹⁰⁻¹³ The clinics took place outdoors using a portable tent as a central storage space for equipment. All providers underwent COVID-19 testing and screening prior to each clinic (supplementary Table 1). All providers wore scrubs as well as appropriate personal protective equipment including an N95 mask, face shield, gloves, gown, and a disposable cap at all times.

Procedure

The inclusion criteria for study participation were as follows: (1) homeless or marginally housed; (2) able and willing to participate; (3) must pass a screening questionnaire for symptoms of COVID-19; (4) temperature less than 38°C; (5) understands the risks and benefits of participating and signs a consent form; (6) over 18 years of age; and (7) able to communicate in

English. The exclusion criteria included: (1) failure to pass a screening questionnaire for symptoms of COVID-19; (2) refusal to have temperature taken or temperature greater than or equal to 38°C; (3) refusal to provide informed consent; or (4) unable to participate in the assessment. The benefits for participants enrolled in this study included a free eye exam, free reading glasses, prescription for ocular medications, and referrals for care when indicated.

Participants were recruited through announcements and registration at local homeless shelters. Additional slots were allocated for individuals residing in nearby encampments to attend on a drop-in basis; these patients were recruited based on their proximity to the screening location. All potential participants underwent COVID-19 screening. Participants who screened negative were provided with a medical grade mask and were required to conduct hand hygiene before entering the clinic. Participants then completed a verbal questionnaire which included general demographic information, place of residence, level of education, monthly income, and past medical and ocular history (supplementary Table 2). These questions were derived from previously validated questionnaires or previously published studies.^{10,13} They were also asked about how the pandemic has affected their general health, quality of life, and access to eye care (Table 1).

Visual acuity was assessed using a Snellen chart for both near and distance vision, with pinhole occlusion to eliminate refractive error. Visual impairment was defined as visual acuity of 20/50 or worse in the eye with better vision. Confrontation visual fields, pupils, and extraocular movements were assessed by a trained examiner. Intraocular pressure was measured using a portable tonometer (Tono-Pen AVIA; Reichert, Buffalo, NY). Each participant was examined

using a portable slit lamp and underwent a dilated fundus examination using an indirect ophthalmoscope. An autorefractor was used to measure the participant's refractive error.

Statistical Analysis

Demographic, clinical characteristics, and outcomes were summarized by standard descriptive statistics. Continuous variables were described in terms of medians and interquartile ranges, while percentages were used for categorical variables.

Results:

Twelve participants across three clinics were recruited. One participant was unable to participate due to intoxication. Eleven participants ultimately underwent all assessments. Six were recruited through shelter announcements and five were allocated to drop-in spots. Figure 1 presents the patient recruitment flow chart. The participants had a median age of 54.5 years (IQR 51.8-59.3), had been homeless for a median of five years (IQR 1.5-7.0), and all were unemployed at the time of screening. Demographic information is presented in Table 2. The majority of participants were male (n=11), Caucasian (n=11), and had at least some high school education (n=5).

Two participants reported alcohol use disorder as well as one each of non-intravenous and intravenous drug use. Six participants reported mental health disorders including depression, post-traumatic stress disorder, and anxiety. One participant had a previous diagnosis of diabetes, and one participant had a diagnosis of hepatitis C. Six of the study participants reported that their health was negatively impacted by the pandemic with four endorsing substantial difficulty due to COVID-19.

Only one participant reported satisfaction with his vision. The ocular conditions reported by study participants are presented in Table 3. Two participants reported a history of ocular surgery, including one case of strabismus repair and one case of retinal detachment repair. Ten participants self-reported an active ocular condition while none had accessed eye care within the preceding year. Ten participants reported wearing prescription glasses currently or in the past. Of these, participants reported that their glasses had either been lost (n=3), stolen (n=2), broken (n=2), or not available at the time of visual assessment (n=3). The median intraocular pressure was 9.5 mmHg (IQR 7.3-11.0).

Five participants demonstrated a visual acuity worse than 20/50 (Table 4), one of which was due to correctable refractive error and four were due to ocular pathology (Table 5), including: nuclear sclerotic cataracts (n=1), moderate non-proliferative diabetic retinopathy (n=1), chalazion (n=1), and pterygia (n=1).

Two patients required a referral to an ophthalmologist for further management as detailed below. Patient four was a 59-year-old African-Canadian man with hypertension and hypercholesterolemia. On examination, his visual acuity was hand motion in both eyes, and the remainder of the exam was unremarkable except for dense nuclear sclerotic cataracts. His most recent ocular examination was by an optometrist in 2019, though he had not been able to follow-up with his referral for cataract surgery due to lack of travel support. Prior to developing cataracts, he reported no previous ocular diseases and had not undergone any ocular surgeries. He completed post-secondary education, lives in subsidized housing, and is currently supported by provincial disability support program. Upon referral he successfully underwent cataract

removal in October 2020 and his post-operative vision was 20/40 in the right eye, and 20/70 in the left eye which improved to 20/20 with appropriate spectacles.

Patient twelve was a 53-year-old Caucasian man with long-standing diabetes and a previous pulmonary embolism. On exam, his visual acuity was 20/63 in both eyes on pinhole refraction. Both pupils were equal and reactive to light without a relative afferent pupillary defect, and his intraocular pressure was 6 mmHg in his right eye and 8 mmHg in his left. His dilated fundus examination was significant for several retinal hemorrhages and hard exudates in both eyes as well as macular edema in his left eye indicating worsening diabetic retinopathy. He had difficulty accessing primary care for management of his diabetes which he reports was exacerbated by the pandemic. His last ocular examination had been in 2019, at which point he was diagnosed with mild diabetic retinopathy. He had no other ocular conditions and no ocular surgical history. He earned a college diploma, is currently supported by a provincial disability support program and lives in subsidized housing. A referral was made to a retina specialist for further follow-up.

Interpretation:

The HMH population is known to experience a higher prevalence of visual impairment than the general population, with previous studies reporting an incidence of 25.2% (95% CI, 16.7%-33.7%) and 5.7% (95% CI, 5.4-6.0), respectively, before the onset of the COVID-19 pandemic.^{4,10,11,14,15} Our study found five individuals experiencing visual impairment. Due to the limited sample size, it is not possible to make a definitive conclusion regarding the effects of the pandemic on the prevalence of visual impairment in this population.

The social determinants of health (SDH) refer to the financial and social factors contributing to the inequalities shaping an individual's health status.¹⁶ Previous research suggests that these factors interact in complex ways to negatively impact the health outcomes in HMH populations.^{4,10,17,18} In particular, studies have shown a bidirectional relationship between socioeconomic status and visual impairment and have established that visual impairment is associated with reduced educational attainment and income level.^{10,11,14} Identifying and mitigating the etiologies of visual impairment may therefore represent an effective and low-cost intervention to improve overall health and quality of life in this vulnerable population.

Our study found that three participants with visual impairment had either completed or partially completed high school without pursuing further education. Limited education is associated with poor health literacy which directly impacts an individual's understanding of their own health and ability to navigate the healthcare system.¹⁷ Existing research also suggests that homeless individuals may experience reduced levels of health literacy and this, in turn, may act as a barrier to accessing care.¹⁹ These factors may help account for the study population's low utilization of healthcare services. Despite the Canadian universal health coverage system and access to emergency ophthalmic care via public insurance, only two participants reported receiving an eye exam in the previous one-year period, compared with 41.0% in the general population.²⁰ Of note, only one participant in this study reported satisfaction with their vision. In part, this may be explained by the fact that routine eye exams for individuals without an ocular condition diagnosed between the ages of 20-64 are not covered by provincial health insurance, unless they are covered by the Ontario Disability Support Program.²¹ Furthermore, some HMH individuals may not have access to OHIP coverage, as is the case for refugees who are no longer covered by

the refugee health program. Ultimately, this limitation may contribute to further ocular health disparities between those who are able to afford care and those who cannot. Screening clinics such as ours represent an important step towards addressing this disparity, given that follow-up ophthalmic care is covered by provincial health insurance after initial diagnosis.

Evolving research also suggests that the COVID-19 pandemic may be contributing to an increased prevalence of mental illness in the general population, which is concerning in that HMH populations already reported higher rates of mental health conditions prior to the pandemic, and the harsh conditions associated with homelessness are known to exacerbate poor mental health.²²⁻²⁵ Within this study, four participants reported that they could “barely get through the day” due to the COVID-19 pandemic. The most commonly reported emotions included "sadness" and "worry".

COVID-19 clinical guidelines reduced in-person clinical activity, which may contribute to underutilization of ocular care services in this population. Online innovations such as telehealth have emerged as a means to provide physically distanced medical care, however, HMH individuals often lack the access to digital devices and private space necessary for online medical appointments. The outdoor, tent-based ocular screening model presented in this study represents a safe and effective means of addressing this disparity while complying with COVID-19 safety regulations. All study personnel received PPE training prior to participation and utilized proper PPE donning and doffing techniques that were supervised by the study administrator. None of the study personnel contracted COVID-19 during the study period. All patients complied with study precautions and those who did not pass screening were offered to reschedule their

appointment at the clinic after they had completed their isolation and were symptom free. The mobile, tent-based model was easily implemented as the researchers were able to erect and deconstruct the tent for each clinic and transport the tent and supplies in a taxicab.

This pilot study helps to lay the groundwork for future research. Future research should focus on evaluating the viability of this targeted intervention in a larger sample of HMH individuals and exploring further solutions to help reduce barriers to care in this population. Such solutions may include investing in technology for the HMH population to receive telemedicine and close collaboration with social workers and shelter staff. Further research should also include an emphasis on mental health outreach due to the high levels of psychological distress reported by participants, as well as assessment and promotion of health literacy. Once regular clinical activities resume, this model for ocular screening clinics will have continued salience as a method for providing care in low resource settings.

The primary limitation of this pilot study was its sample size, which limits the direct comparability of the results of this study to the broader population. This was largely impacted by inclement weather which is common to the geographic location and timing of this study and impacted our ability to conduct expansive outdoor clinics. Another limitation was the lack of a control group which may have contributed to selection bias. The equipment utilized in this study also introduces some limitations as a portable slit lamp is less reliable than a traditional slit lamp and autorefraction was used as opposed to manual refraction. Finally, as the study was conducted early in the course of the COVID-19 pandemic, the prevalence reported may not fully represent

the status of ocular health among the HMH throughout the second and third waves of the pandemic

This pilot study represents the first proposed model for successfully conducting ocular screening clinics safely during COVID-19. To the best of our knowledge, it also constitutes the first assessment of the ocular health of HMH populations during the pandemic. Our results suggest that community-based mobile clinics such as ours may present an effective method for providing care to this vulnerable population during COVID-19. As the pandemic continues to shape the healthcare landscape, it is essential that the current standard of ocular health care provision evolves to meet the needs of this population and overcome barriers to accessing care.

Author Statement:

Jacqueline Slomovic: conceptualization, methodology, formal analysis, investigation, writing- original draft, writing- review and editing. **Verina Hanna:** formal analysis, investigation, resources, writing- original draft, writing- review and editing, visualization. **Yuri Chaban:** formal analysis, investigation, resources, writing- original draft, writing- review and editing, visualization. **Josha Rafael:** writing- original draft, writing- review and editing, visualization. **Marko M. Popovic:** methodology, formal analysis, writing- review and editing. **Parnian Arjmand:** formal analysis, investigation, writing- review and editing. **Victoria Wylson- Sher:** conceptualization, methodology, investigations, resources, data curation, writing- review and editing, project administration, funding acquisition. **Myrna Lichter:** conceptualization, methodology, validation, investigation, resources, writing- review and editing, supervision, project administration, funding acquisition.

Declaration of Competing Interest

Jacqueline Slomovic MSc MD(C)- Conflicts of interest: None

Verina Hanna MD(C)- Conflicts of interest: None

Yuri Chaban MD(C)- Conflicts of interest: None

Josha Rafael MD(C)- Conflicts of interest: None

Marko M. Popovic MPH(C) MD- Conflicts of interest: PSI Foundation

Parnian Arjmand MSc MD FRCSC- Conflicts of interest: None

Victoria Wylson- Sher BA- Conflicts of interest: None

Myrna Lichter MD FRCSC- Conflicts of interest: None

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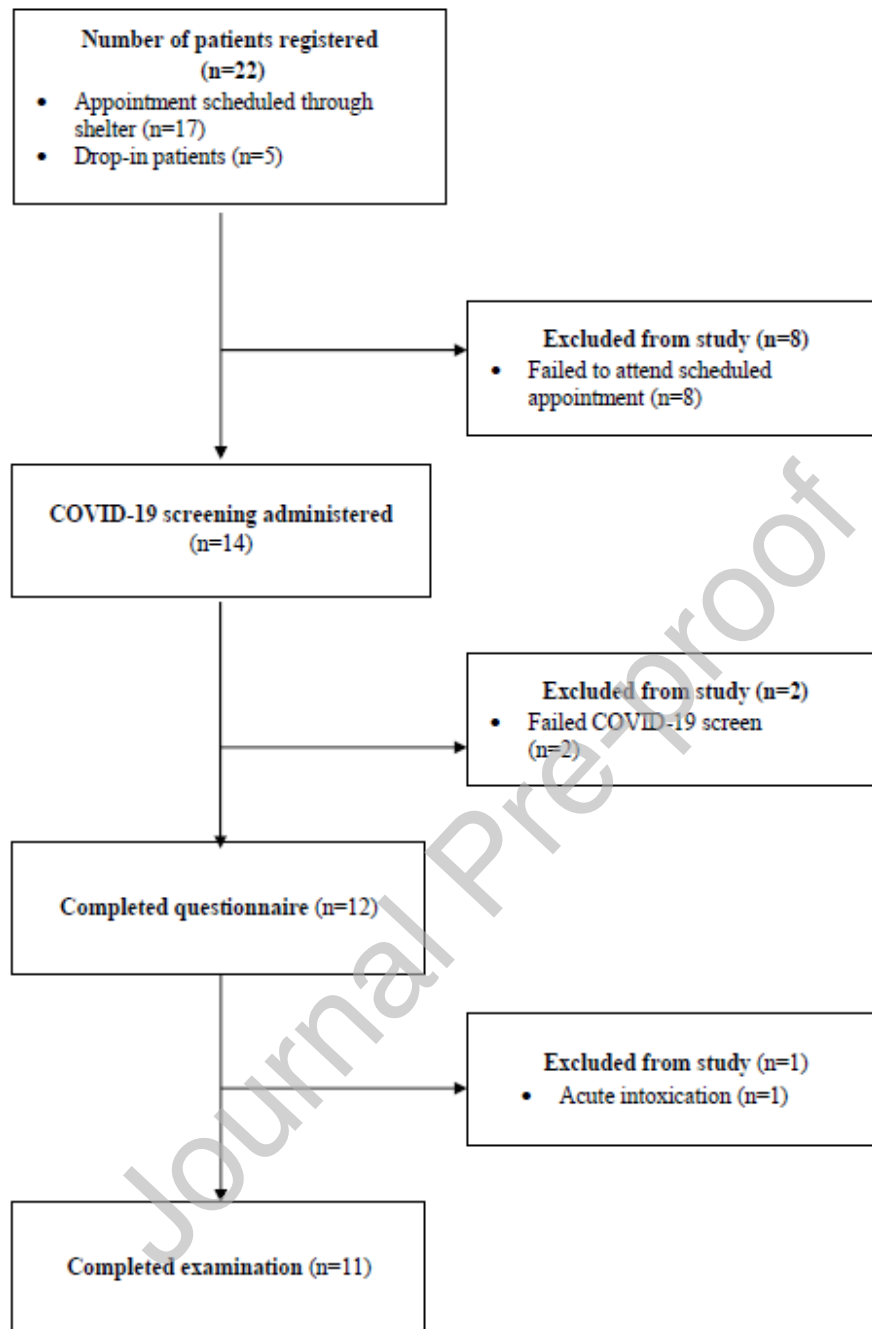


Figure 1. Patient recruitment flow chart, including the total number contacted, those excluded from study, and the number of questionnaires and examinations completed

Table 1. Provider-administered questionnaire regarding quality of life, health, and access to eye care during the COVID-19 pandemic.

Item #	
#1	When was the last time you had your eyes tested? (YYYY/MM) _____ Where? _____
#2	Are you satisfied with your vision? <input type="checkbox"/> Yes <input type="checkbox"/> No
#3	Did you have difficulty accessing eye care before the pandemic? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, why? _____ _____
#4	Has the pandemic affected your ability to seek eye care? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, how? _____ _____
#5	On a scale from 1-10, how much has your eye health affected your quality of life in the past year? (10 = significant effect, 1 = no effect) _____
#6	On a scale from 1-10, how concerned are you about your eye health? (10 = very concerned, 1 = not concerned) _____
#7	Where would you prefer to receive free eye care? <input type="checkbox"/> Hospital Emergency Department <input type="checkbox"/> Walk-in Clinic <input type="checkbox"/> Mobile Clinic in Shelter <input type="checkbox"/> Mobile Clinic in Outdoor Tent <input type="checkbox"/> Other
#8	Has the pandemic affected your general health? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, how? _____ _____
#9	What is the impact of the COVID-19 pandemic on your daily life? <input type="checkbox"/> Can barely get through the day <input type="checkbox"/> Can get through the day with difficulty <input type="checkbox"/> I can manage <input type="checkbox"/> Some problems, not too big of a deal <input type="checkbox"/> I don't notice much of a difference from my days before the COVID-19 pandemic
#10	What words best describe the way you feel during the COVID-19 pandemic? <input type="checkbox"/> Afraid <input type="checkbox"/> Sad <input type="checkbox"/> Worried <input type="checkbox"/> Same as before <input type="checkbox"/> Optimistic <input type="checkbox"/> Content

Table 2. Demographic characteristics

Characteristic	Number of Participants (%)
Sex	
Male	11 (91.7)
Female	1 (8.3)
Age (years)	
40-49	3 (25.0)
50-59	6 (50.0)
> 60	3 (25.0)
Total years spent homeless*	
<1	2 (18.1)
1-5	4 (36.4)
>5	5 (45.5)
Ethnicity	
Caucasian	7 (58.3)
African-Canadian	3 (25.0)
Indigenous	2 (16.7)

Marital status	
Married	0
Divorced	4 (33.3)
Separated	2 (16.7)
Single	6 (50.0)
Highest level of education achieved	
Some High School	5 (41.7)
Completed High School	4 (33.3)
Some Post-Secondary	1 (8.3)
Completed Post-Secondary	2 (16.7)
Monthly Income (CAD)	
Less than \$500	6 (50.0)
\$500-\$1000	0
Greater than \$1000	6 (50.0)
Income Support	
Ontario Works	6 (50.0)
Ontario Disability Support Program	6 (50.0)

*Only eleven patients responded with the number of years they had been homeless.

Table 3. Questionnaire results

Questionnaire Item [item number if applicable]	Number of Participants (%) or scale (median, interquartile range)
Owned prescription or contact lenses	
Yes	10 (83.3)
No	2 (16.7)
Previous ocular diagnosis	
Cataract	1 (8.3)
Retinal detachment	1 (8.3)
Previous eye surgery or procedure	
Strabismus repair	1 (8.3)
Retinal detachment repair	1 (8.3)
Most recent ocular examination [1]	
<2	2 (16.7)
2-4	6 (50.0)
5-10	2 (16.7)
>10	2 (16.7)

Satisfied with vision [2]	
Yes	1 (8.3)
No	11 (91.7)
Difficulty accessing eye care prior to pandemic [3]	
Yes	1 (8.3)
No	11 (91.7)
Pandemic impacted ability to seek eye care [4]	
Yes	5 (41.7)
No	7 (58.3)
Quality of life impacted by eye health (1-10) [5]	6.0 (4.5-7.0)
Concern for eye health (1-10) [6]	9.0 (7.0-10.0)

Preferred eye care environment [7] Emergency room Walk-in clinic Shelter eye clinic Mobile tent clinic Other	 2 (16.7) 3 (25.0) 1 (8.3) 4 (33.3) 2 (16.7)
Pandemic impacted general health [8] Yes No	 6 (50.0) 6 (50.0)
Impact of COVID-19 on daily living (1-10) [9] Can barely get through the day Can get through the day with difficulty I can manage Some problems, not too big a deal I don't notice much of a difference from my days before COVID-19	4.0 (3.0-4.25) 4 (33.3) 0 2 (16.7) 5 (41.7) 1 (8.3)

Best description of feelings during COVID-19 [10]	
	3 (25.0)
Afraid	3 (25.0)
Sad	4 (33.3)
Worried	2 (16.7)
Same as before COVID-19	0
Optimistic	0
Content	

Table 4. Visual acuity according to the North American Standard Classification

Visual acuity	Presenting visual acuity (number of participants, %)	After pinhole correction (number of participants, %)
Not impaired		
20/20 or better	1 (9.1)	2 (18.2)
20/25-20/30	5 (4.5)	4 (36.4)
20/40	0	1 (9.1)
Low vision		
20/50-20/100	2 (18.2)	3 (27.3)
Blind		
20/200 or worse	3 (27.3)	1 (9.1)

Table 5. Ocular pathology of eleven homeless participants sampled

Ocular pathology	Number of participants (%)
Cataracts (bilateral)*	1 (9.1)
Chalazion	1 (9.1)
Non-proliferative diabetic retinopathy (moderate, bilateral)	1 (9.1)
Pterygia (bilateral)	1 (9.1)

*World Health Organization Grade NUC-3